

SARDAR PATEL UNIVERSITY
Programme & Subject: M.Sc (Biomedical Science)
Semester: IV
Syllabus with Effect from: June - 2014

Paper Code: PT04CBMC01		Total Credit: 4
Title of Paper: Medical Imaging, Medical Sensors and Diagnostics		
Unit	Description in Detail	Weightage (%)
I	Medical imaging techniques: Photography and film image: Principle of photography and radiographic film image, film sensitometry, information content of an image, image quality factors (resolution, contrast, noise), MTF. Detectors: ionization chamber, proportional counter, Geiger-Muller counter, scintillation detectors, semiconductor radiation detector, efficiency and sensitivity of detectors. Image intensifier, automatic brightness control system, image distortion and artifacts. Fluoroscopy and angiography: Over view of Fluoroscopic imaging system, principle, specific system design. Digital fluoroscopy-c-arm system. Digital subtraction angiography (DSA), digital subtraction programming	25%
II	Advanced Medical Imaging Tools: Introduction to digital image: Signal input, image matrix, digital image quality, digital image processing, picture archiving and communication system (PACS). X-Ray computed tomography: Principles of sectional imaging, scanner configuration, detectors, data acquisition system, image formation principles, conversion of x-ray data in to scan image. 2D image reconstruction techniques: back projection, iterative and analytical methods. Viewing system, image quality and artifacts	25%
III	Applications of Medical Imaging: Ultra Sound in Medicine: Introduction, production of ultrasound, acoustic impedance, ultrasonic transducers and types, transmitter and detector principles, probe design, principles of image formation. Display system: principles of A-mode, B-mode and M-mode display. Principles of scan conversion (real time imaging), image processing, Doppler Ultra sound and Colour flow mapping. Applications of diagnostic ultra sound. Magnetic Resonance Imaging: Introduction, principles of MRI, MRI instrumentation, magnets, gradient system, RF coils- receiver system. Relaxation processes, pulse sequence, image acquisition and reconstruction techniques, Functional MRI - Application of MRI. Radio isotope imaging / Nuclear medicine: Radio nuclides for imaging, radionuclide production: cyclotron production, reactor production, generator production. Rectilinear scanners, Linear scanners, SPECT, PET, Gamma Camera, Comparison of other tomographic techniques. Principle of Computed Tomography (CT) Scan, Operational Modes, First, second, third and fourth generation scanner, System Components and Gantry	25%
IV	Medical Sensors and their classification: Electrodes as bioelectric transducers: The electrode-electrolyte interface; Specification and selection criteria for electrodes; Medically significant measurands, sensing methods for biological signals; Sensor characteristics: linearity, repeatability, hysteresis, drift; Sensor models in the time and frequency domains; Sensors for physical measurands: strain, force, pressure, acceleration, flow, volume, temperature and biopotentials. Sensors for measurement of chemicals: potentiometric sensors, ion selective electrodes, ISFETS; Amperometric sensors, Clark Electrode; Catalytic biosensors, immunosensors	25%



Basic Text & Reference Books:-

- K. Kirkshung, M.B. Smith, Benzamin Tsui, Principles of Medical Imaging, Academic Press.
- R. S. Khandpur, Handbook of Bio-Medical Instrumentation, Tata McGraw Hill.
- J. Webster, Bioinstrumentation, Wiley and Sons
- D. L. Wise, Applied Bio Sensors, Butterworth, London.

